

Hit Kalman Filter Performance Update

Larsoft Tracking/Reconstruction Meeting

Oct. 31, 2012

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Overview

- The last Hit Kalman filter track talk was on Aug. 8.
- Since then, there have not been any significant changes in the reconstruction algorithm. There are some improvements in the track analyzer module TrackAna.
 - Mainly reco-mc matching histograms are now organized in separate root directories according to mc pdg particle id.
- Results in current talk are focused on measuring tracking performance with more statistics, and in more realistic and more challenging environments.
 - Larger angles and lower momentum.
 - Genie events.

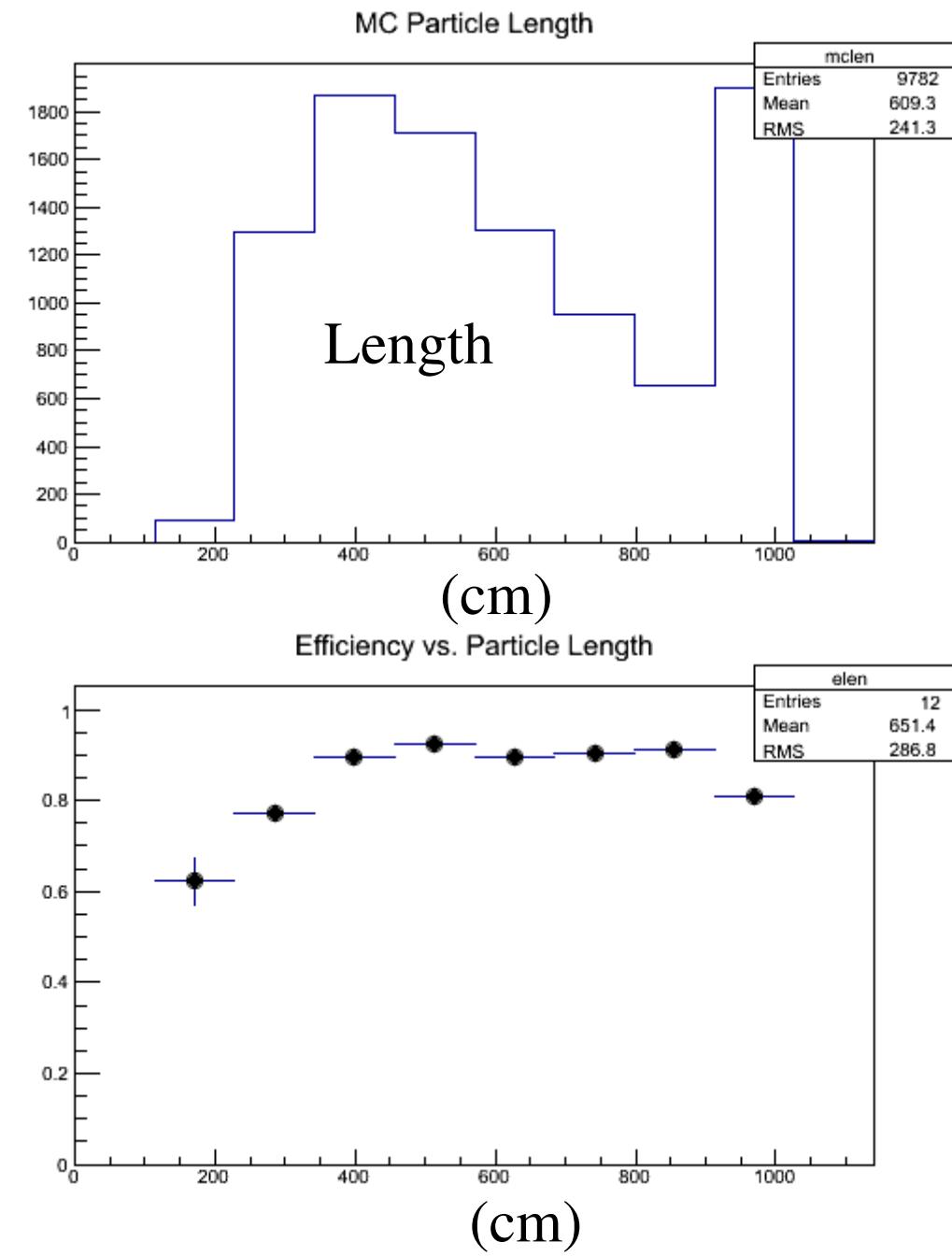
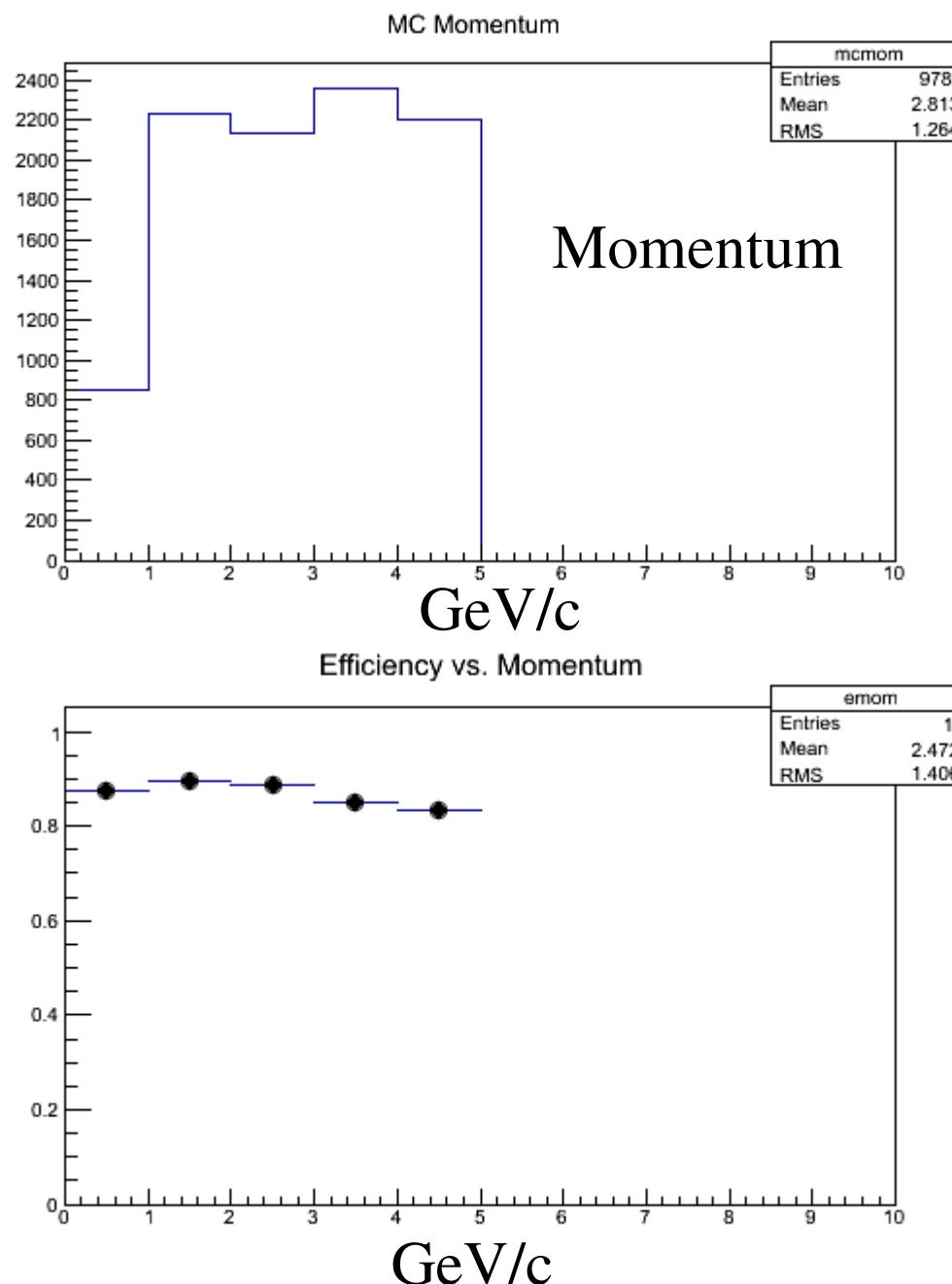
MC Test Samples

- Forward single muons (5000 events).
 - Flat momentum 0.5–5.0 GeV/c.
 - $\theta = 0 \pm 10^\circ$ (both projections).
 - Near front of detector.
- Wide angle single muons (5000 events).
 - Flat momentum 0.1–2.0 GeV/c.
 - Flat angular distribution (quasi-isotropic).
 - Full volume.
- Genie ν_μ CC events (5000 events).

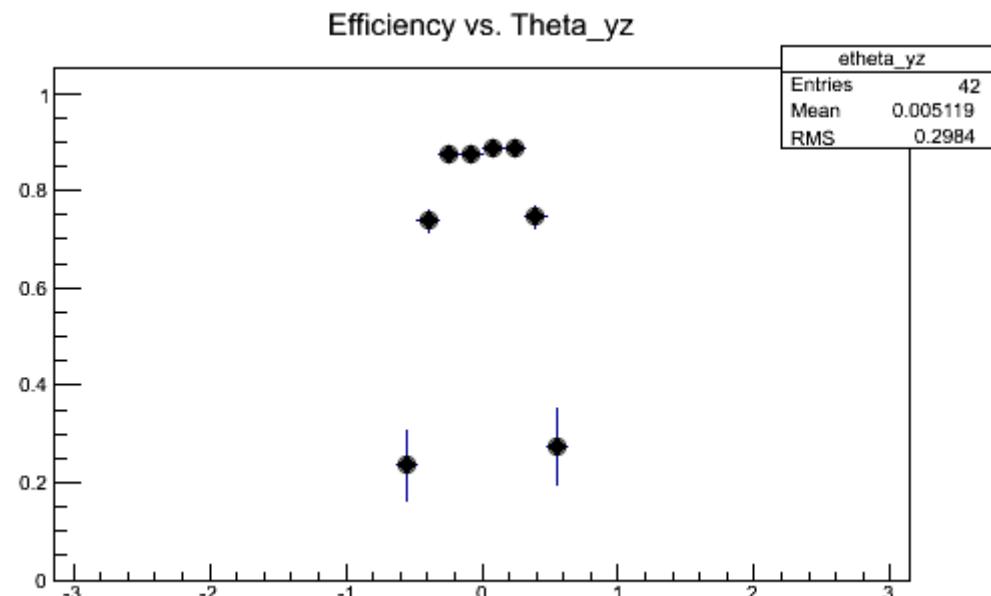
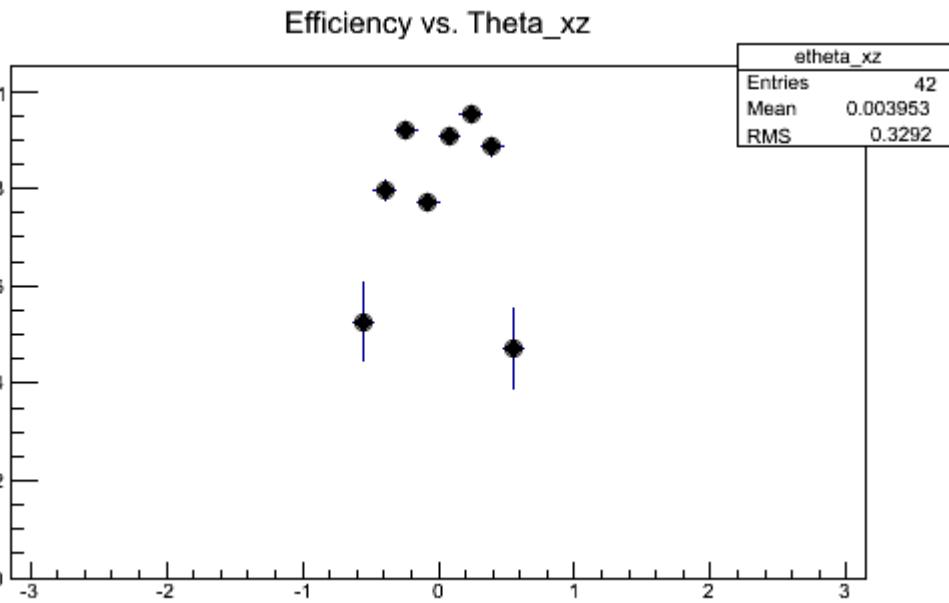
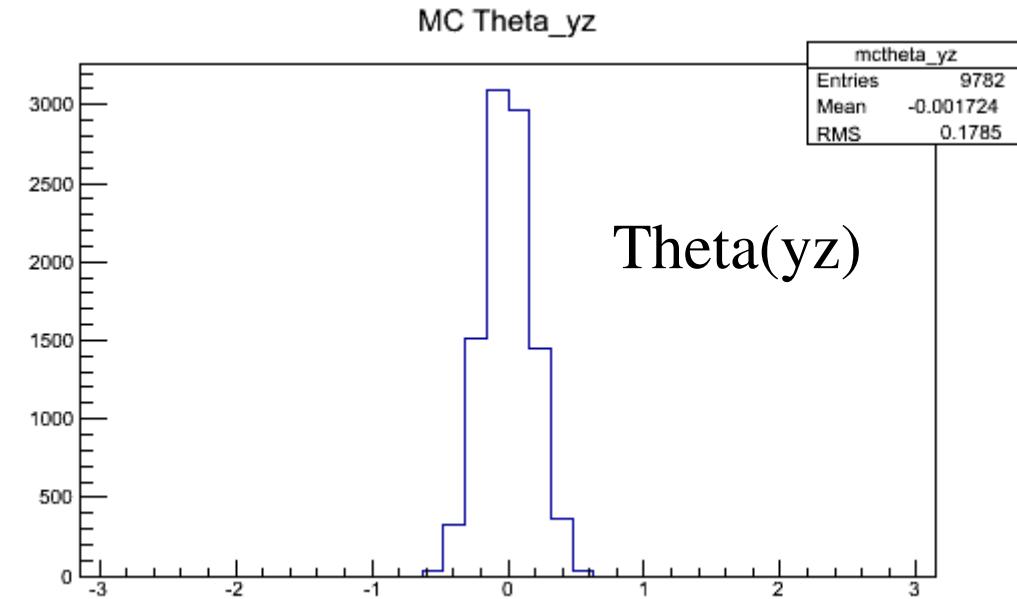
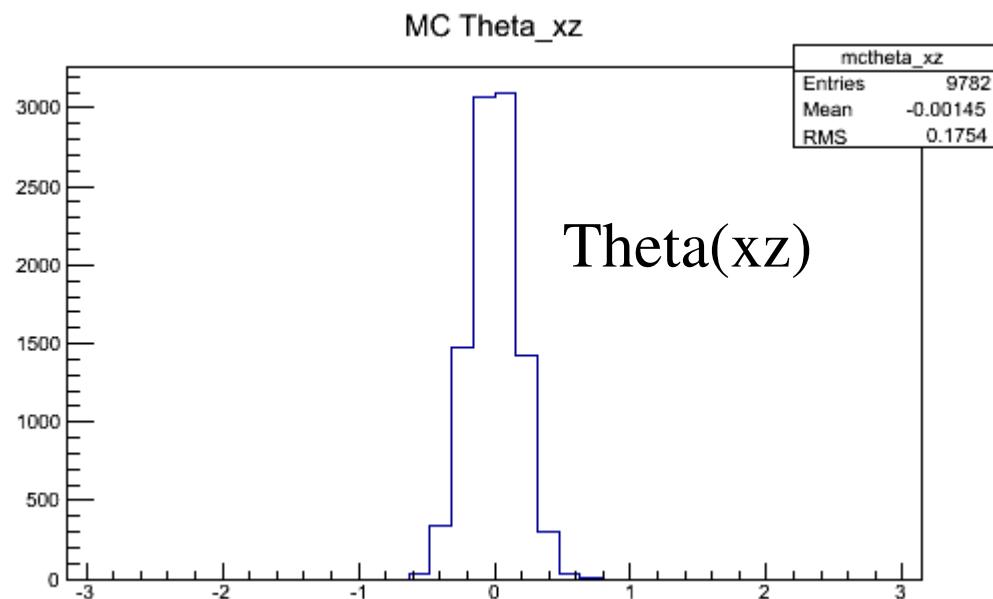
Track Selection & Matching

- Tracks reconstructed using Track3DKalmanHit from frozen release S2012.09.18.
- Reco track selection.
 - Kinetic energy $> 0.5 \text{ GeV}$.
- MC-Reco matching.
 - Start position $\Delta r_{uv} < 2 \text{ cm}$.
 - Start position $\Delta w < 2 \text{ cm}$.
 - Colinearity > 0.99 .
 - Additionally require $(\text{reco length}) > 0.5 * (\text{mc length})$ for track to be considered “well reconstructed.”

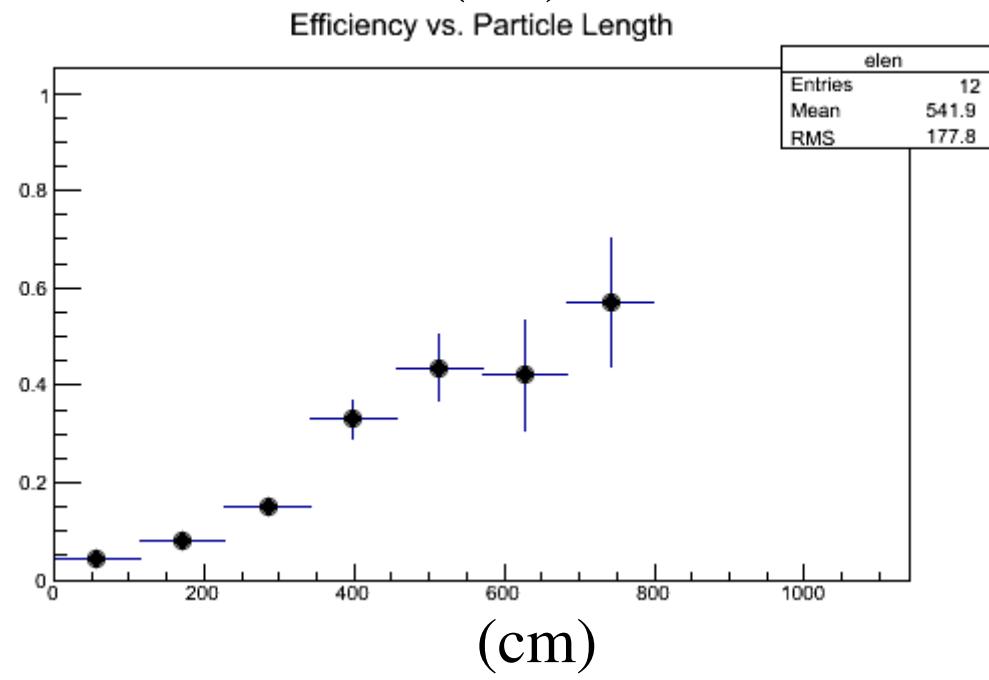
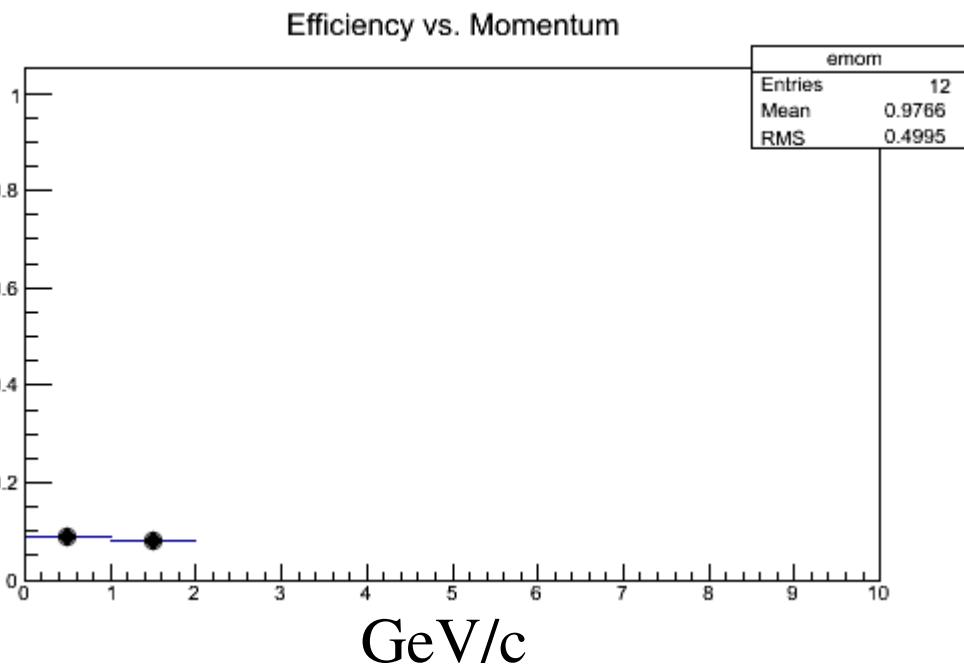
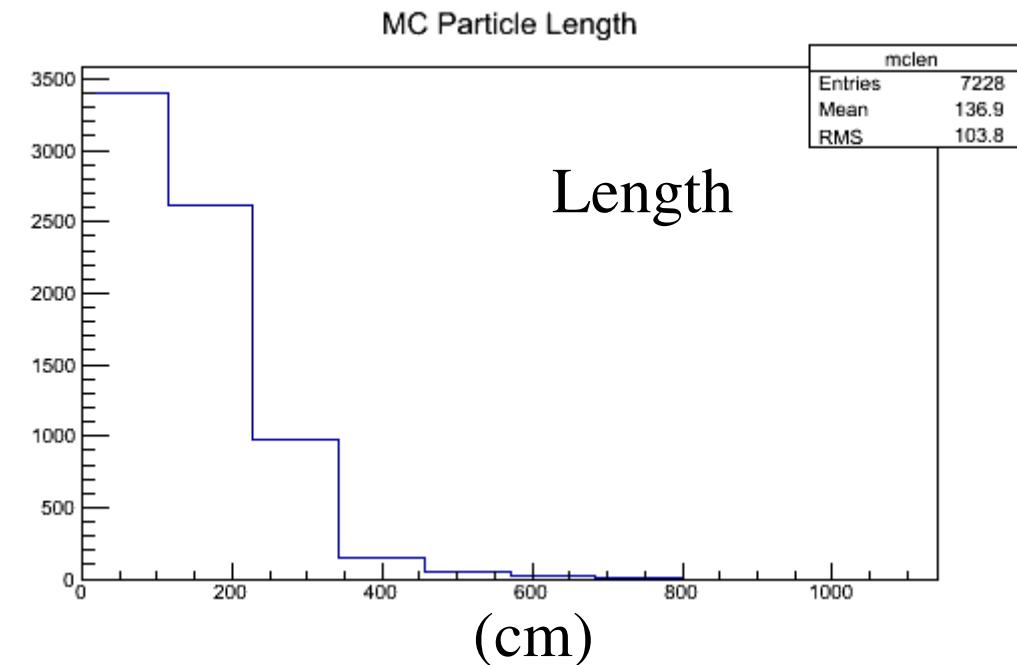
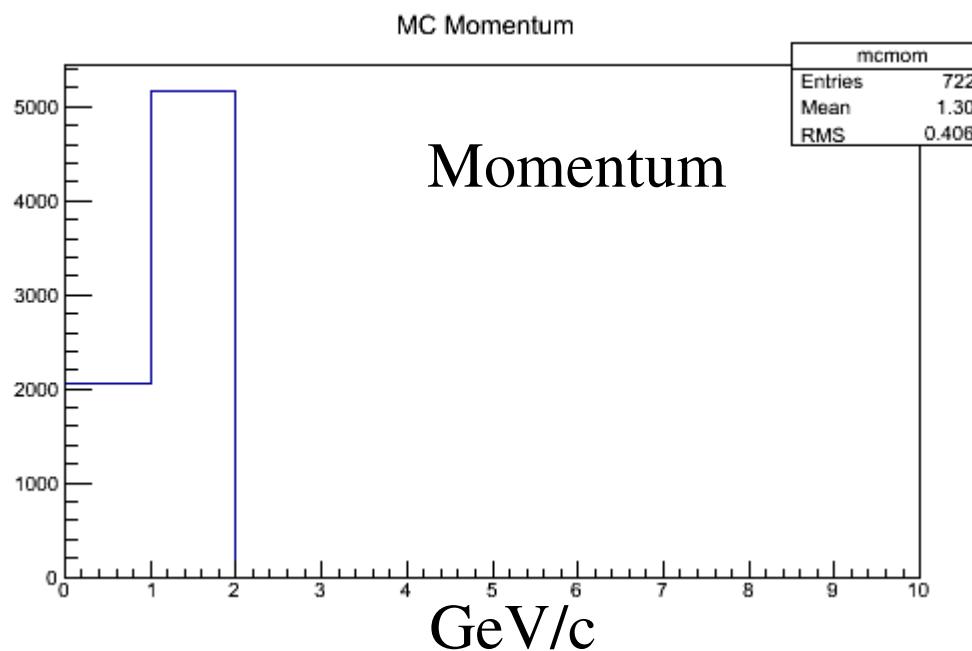
Forward Single Muons I



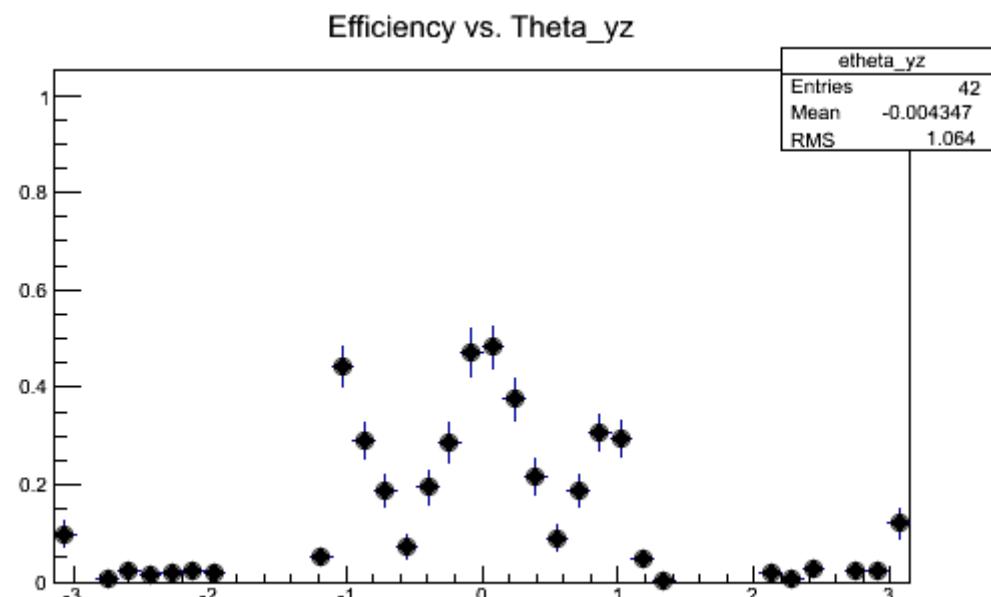
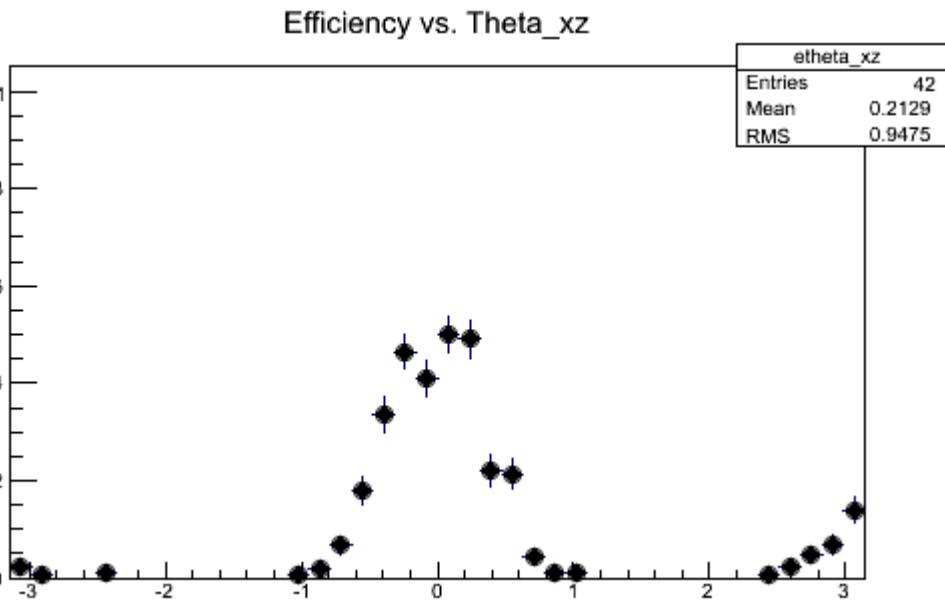
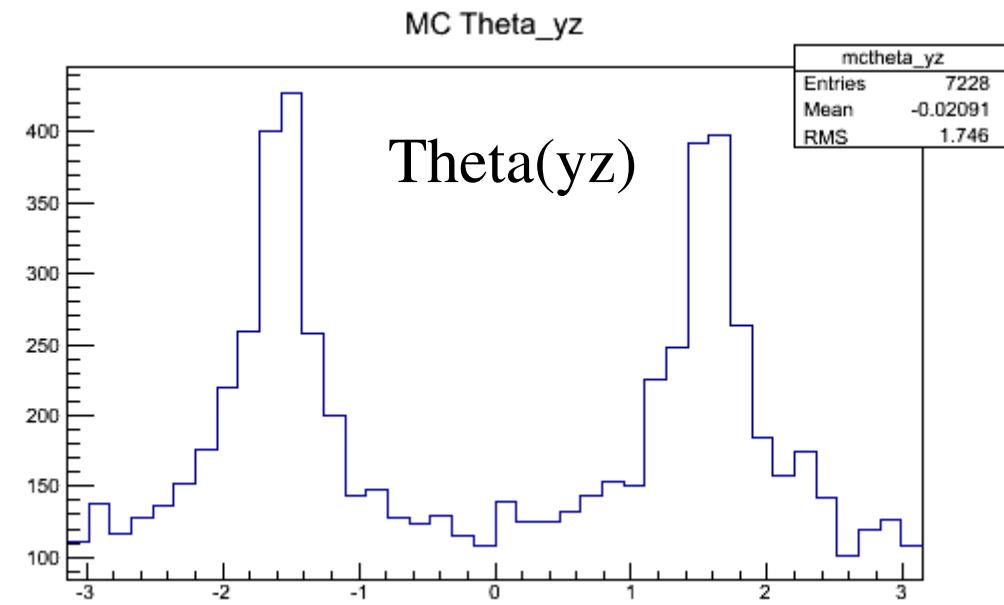
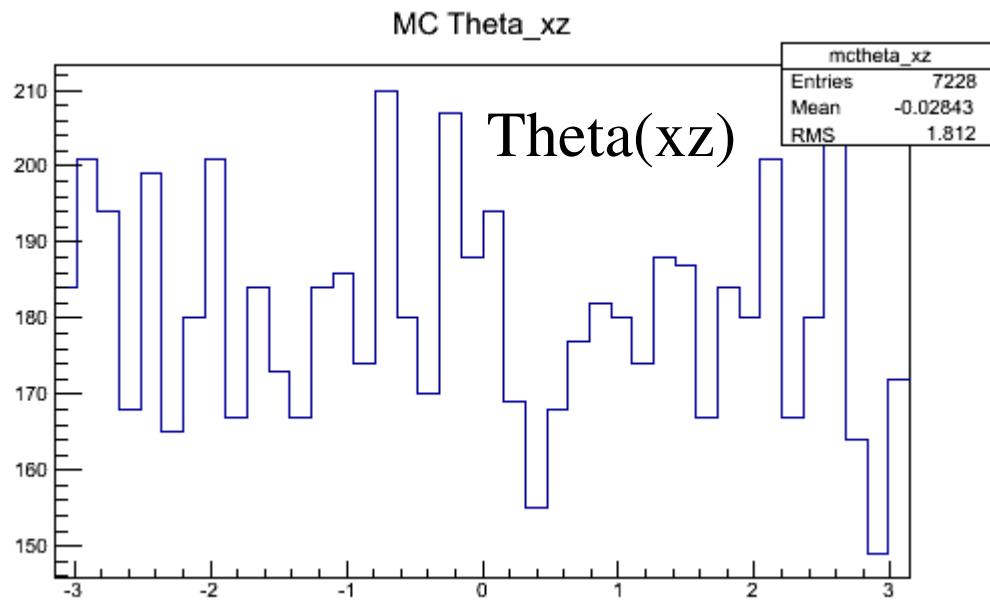
Forward Single Muons II



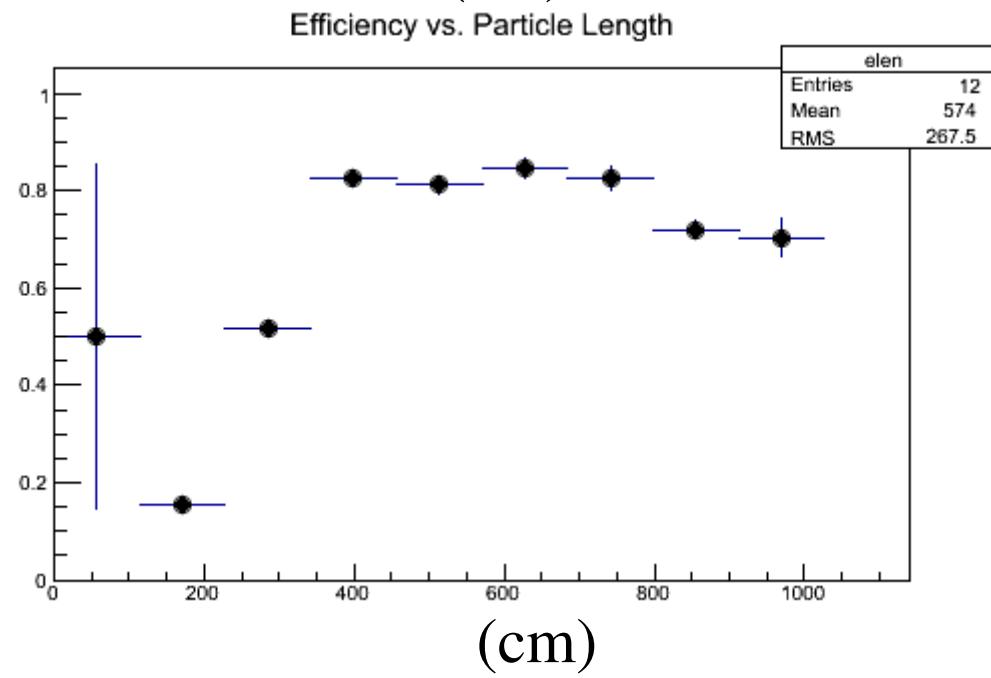
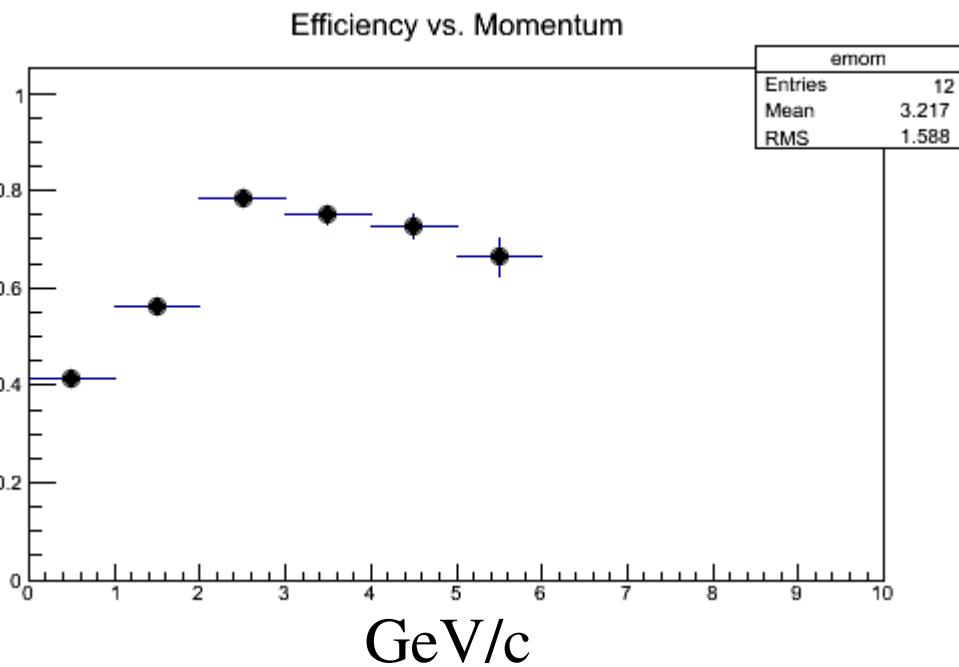
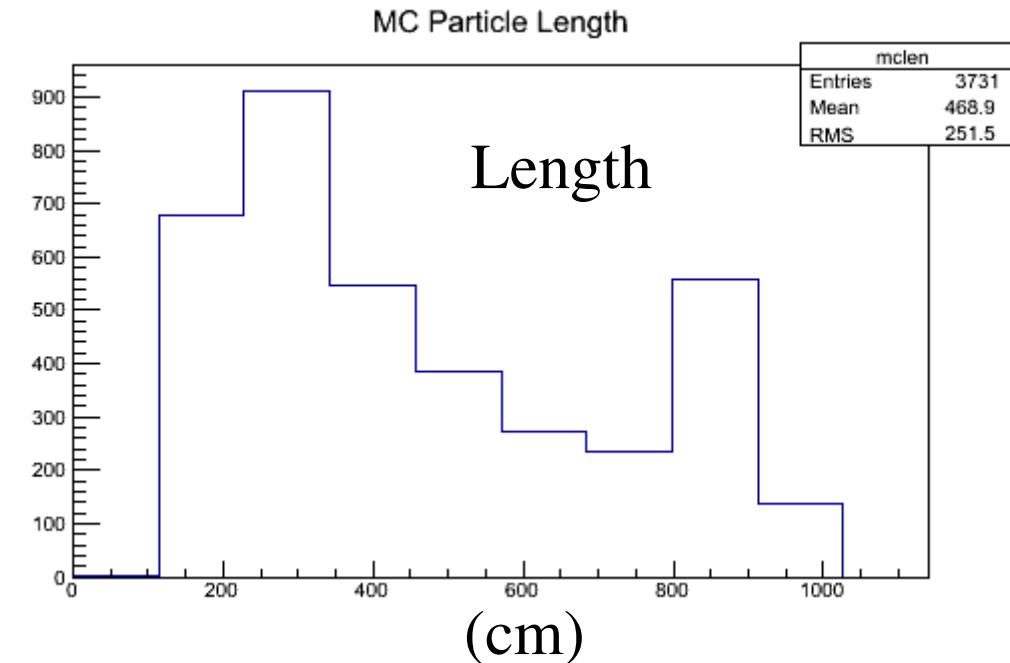
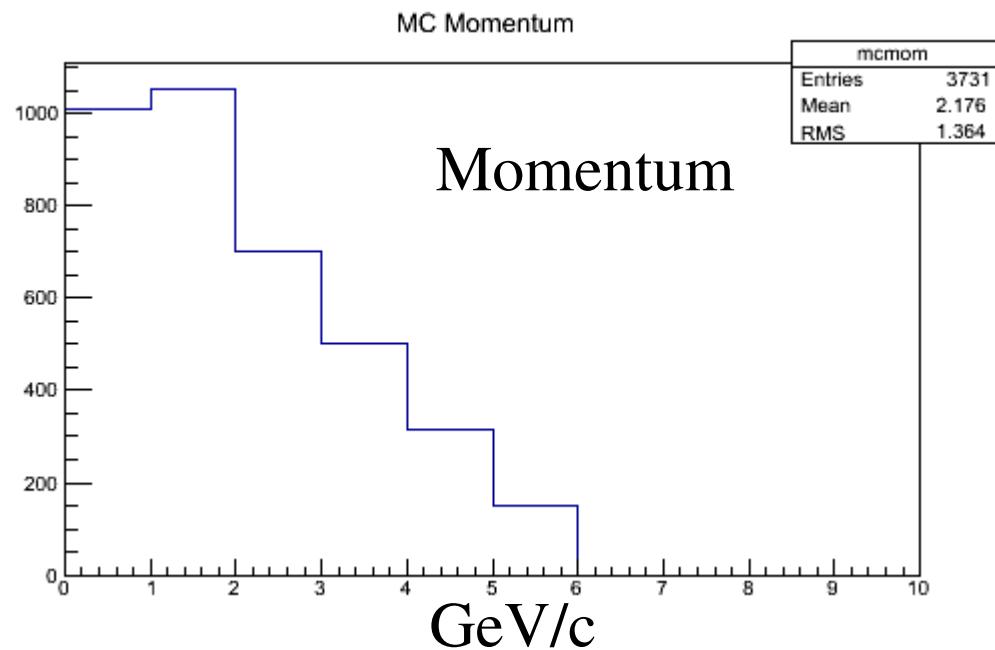
Wide Angle Single Muons I



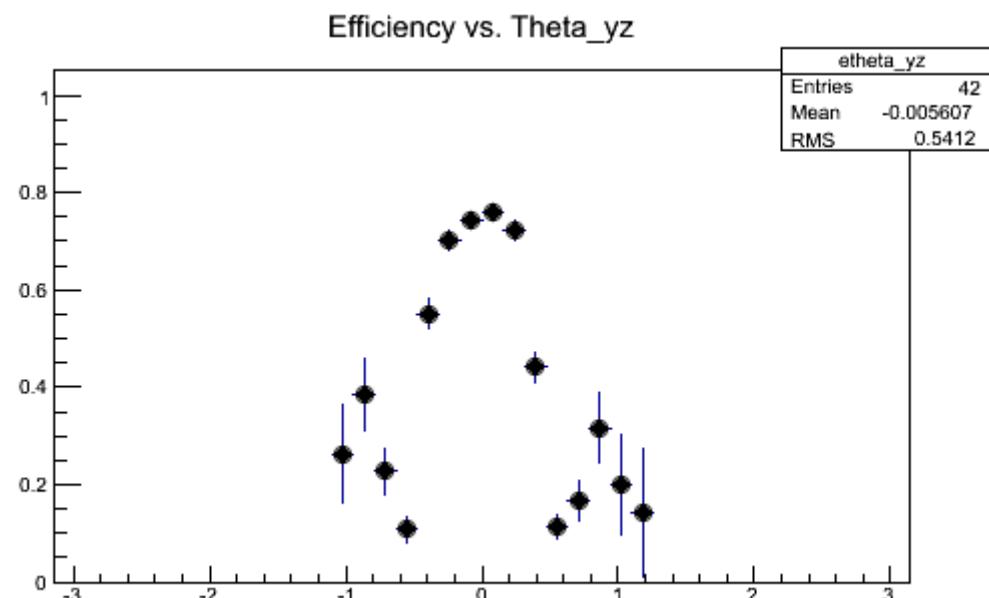
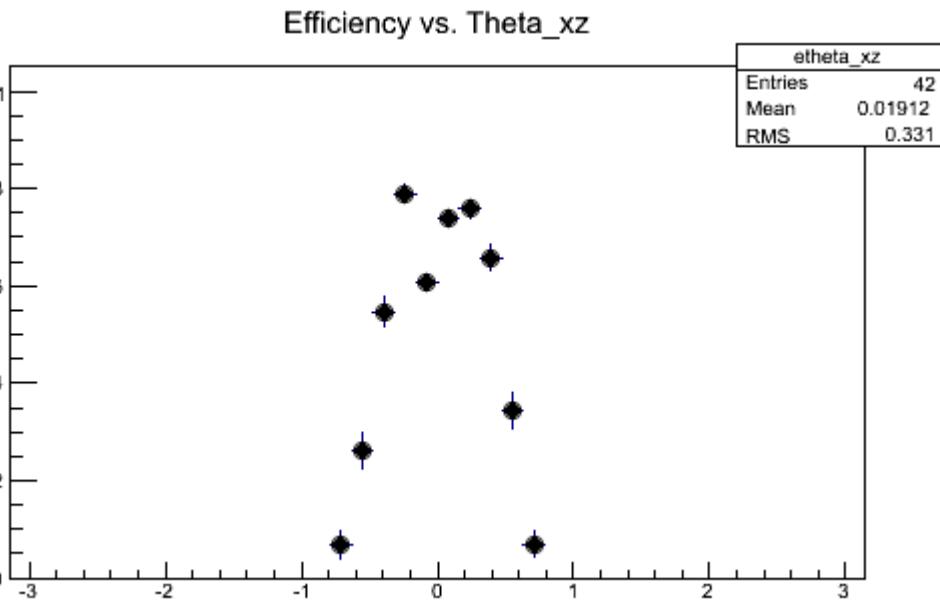
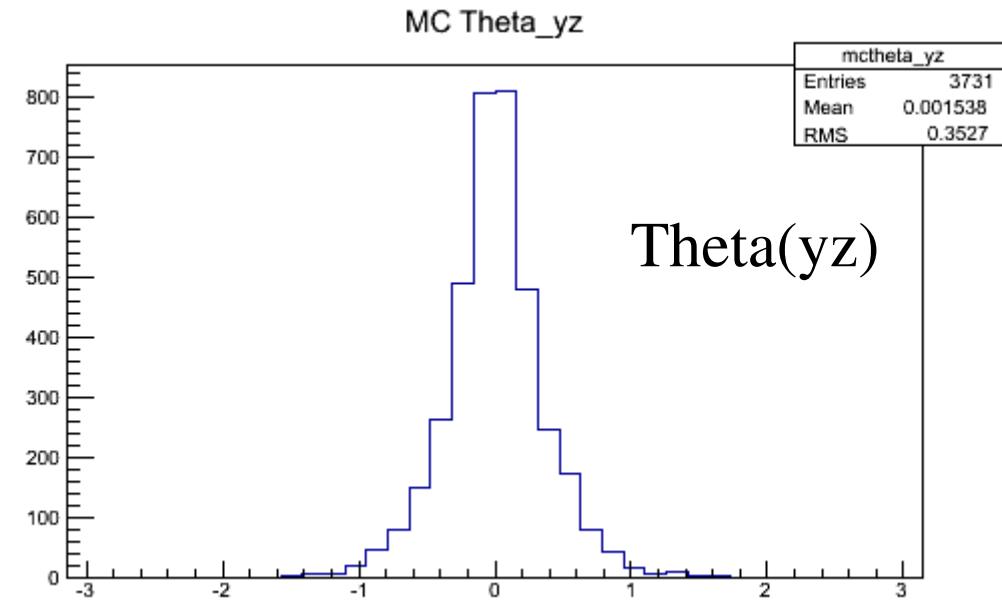
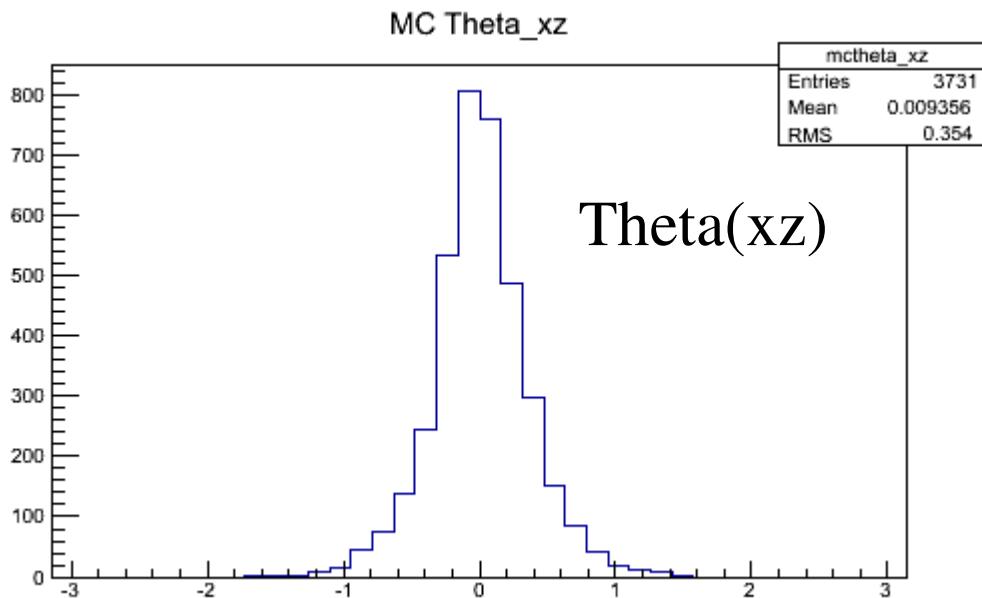
Wide Angle Single Muons II



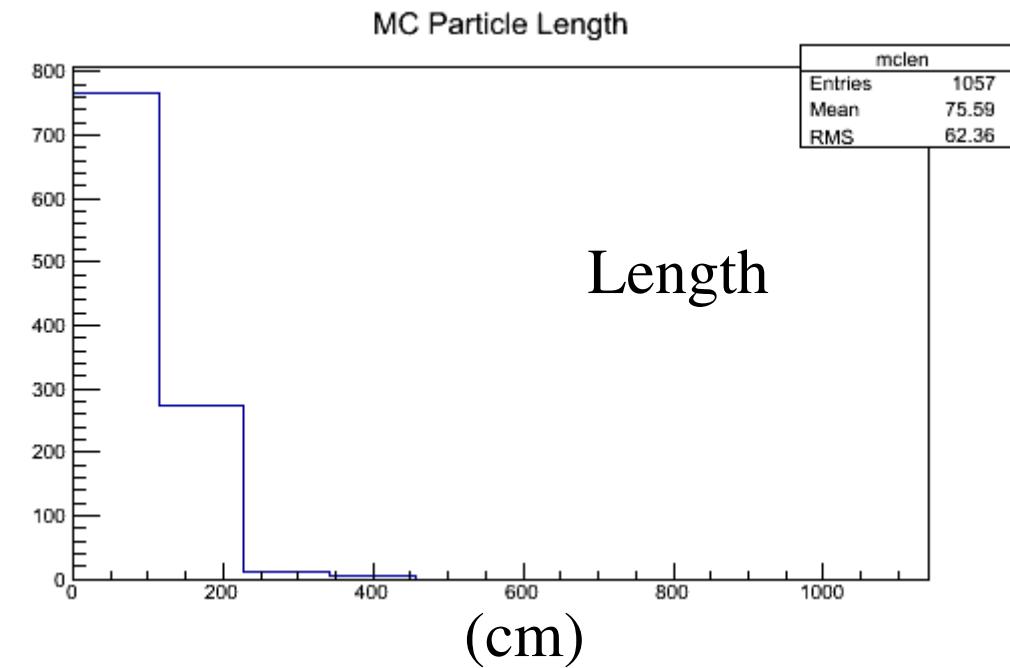
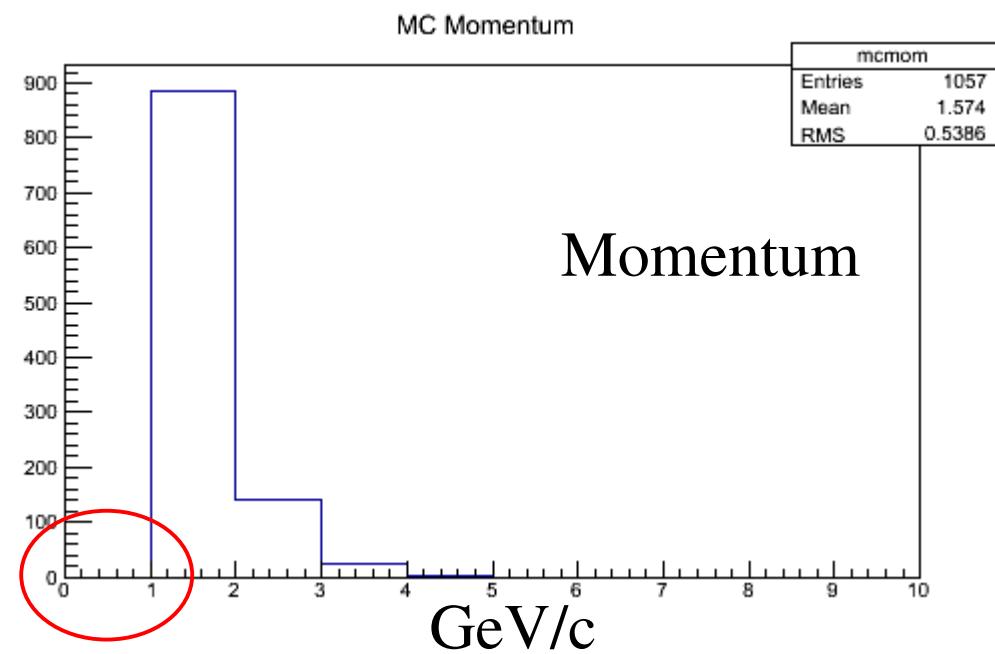
Genie Muons I



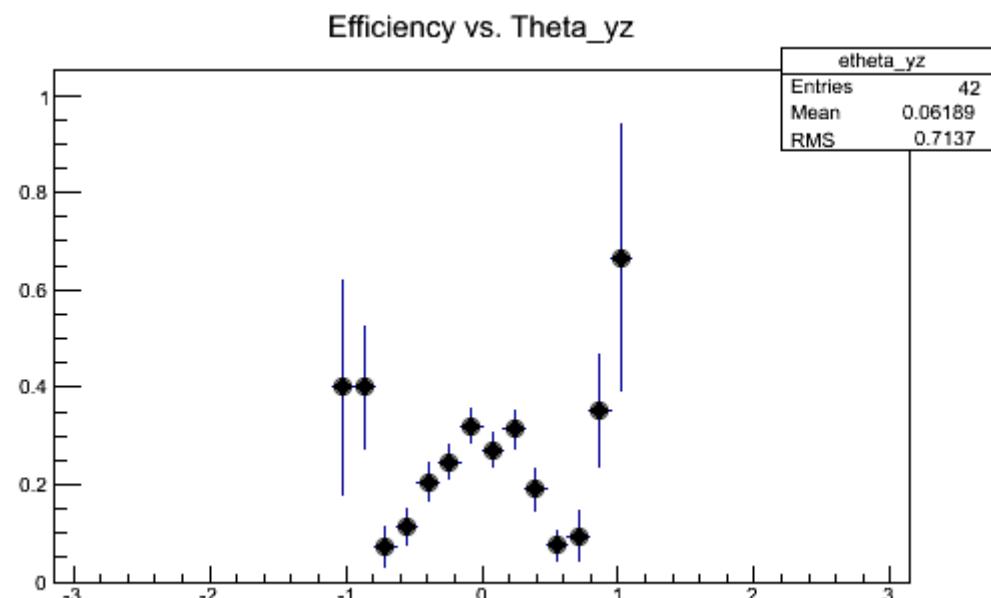
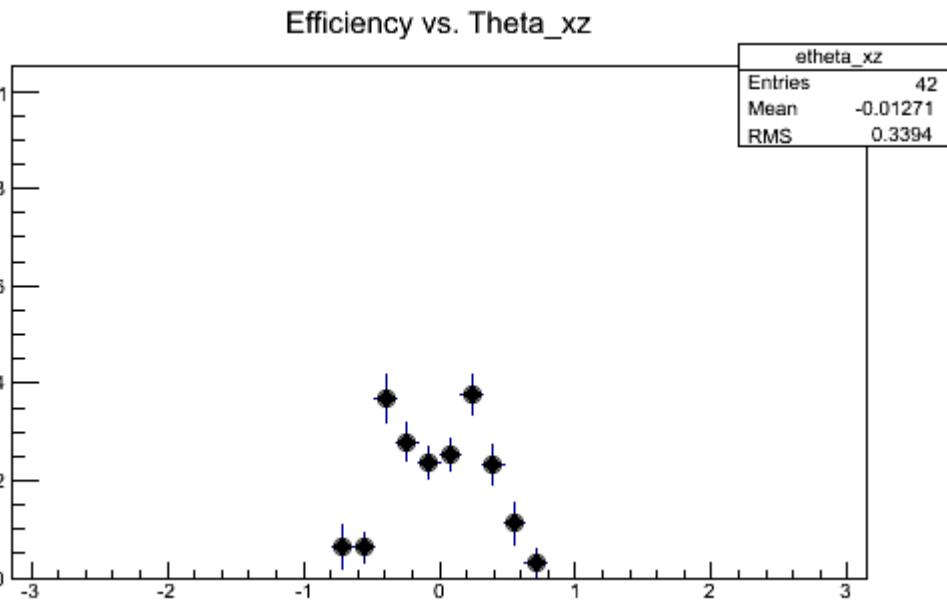
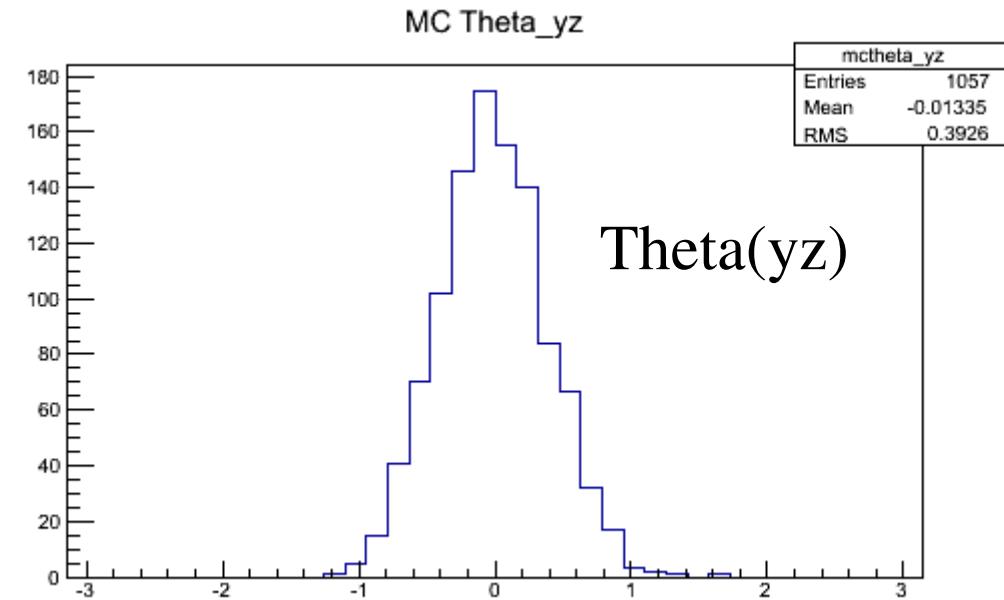
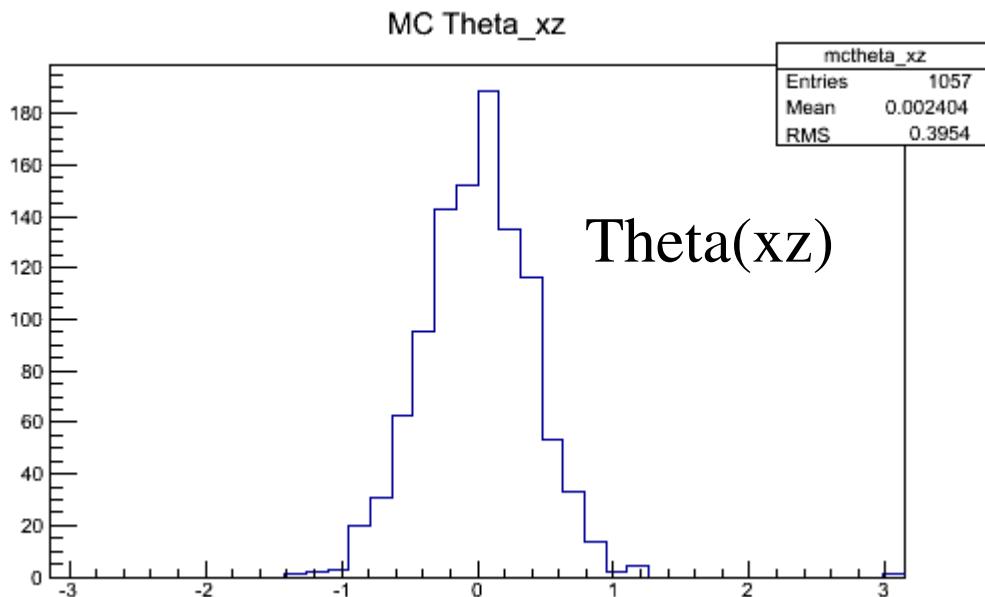
Genie Muons II



Genie Protons I



Genie Protons II



Summary

- Long, small angle tracks reconstructed with high efficiency.
- Efficiency drops for low momentum/short tracks.
- Efficiency drops for high angle tracks (especially tracks parallel to readout wires).